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(71) Applicant *(for all designated States except US)*: HEWLETT-PACKARD COMPANY [US/US]; 3000 Hanover Street, Palo Alto, CA 94304 (US).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: I'ANSON, Colin [GB/GB]; 16 Kynges Mill Close, Frenchay, Bristol BS16 1JL (GB).

(74) Agent: SQUIBBS, Robert, Francis; Hewlett-Packard Limited, Intellectual Property Section, Filton Road, Stoke Gifford, Bristol BS34 8QZ (GB).

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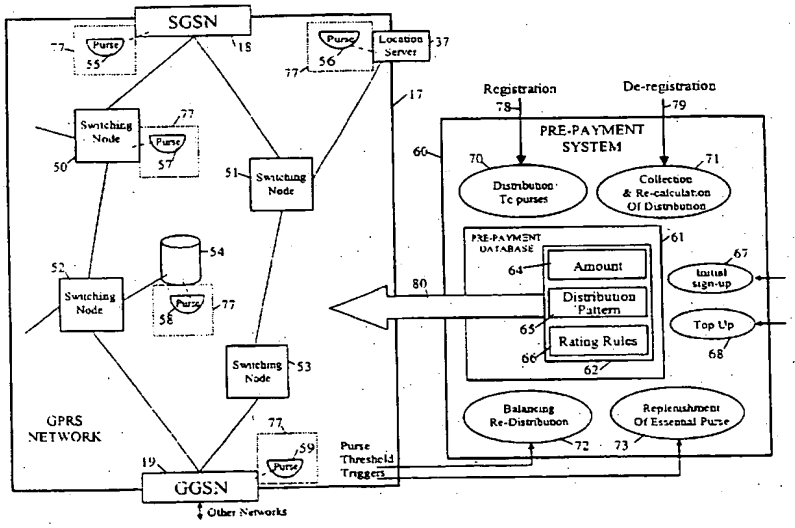
(54) Title: OPERATING A COMMUNICATIONS INFRASTRUCTURE ON A PRE-PAYMENT BASIS



(57) Abstract: Subscribers to a communications infrastructure, such as a GPRS network (17), can pre-pay for use of metered resources (18, 19, 37, 50, 54) of the infrastructure. When a pre-payment subscriber joins the network, the current credit amount for the subscriber is distributed as credit values between user-specific virtual purses (55-59) each associated with a respective metered resource. Upon use of a metered resource by the subscriber, the credit value held in the associated purse is correspondingly reduced, with use of the resource being dependent on the purse being in credit. The virtual purses are preferably electronically distributed to be close by the metered resources to which they relate whereby to reduce network billing traffic. When the subscriber leaves the network, the remaining credit values are consolidated from the purses.

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Operating a Communications Infrastructure on a Pre-Payment Basis

Field of the Invention

The present invention relates to a method of operating a communications infrastructure on a pre-payment basis and in particular, but not exclusively, to the operation of a GPRS network on a pre-payment basis. The present invention also relates to communication infrastructures adapted to operate on a pre-payment basis.

Background of the Invention

Communication infrastructures suitable for mobile users (in particular, though not exclusively, cellular radio infrastructures) have now become widely adopted. Whilst the primary driver has been mobile telephony, the desire to implement mobile data-based services over these infrastructures, has led to the rapid development of data-capable bearer services across such infrastructures. This has opened up the possibility of many Internet-based services being available to mobile users.

By way of example, Figure 1 shows one form of known communication infrastructure for mobile users providing both telephony and data-bearer services. In this example, a mobile entity 20, provided with a radio subsystem 22 and a phone subsystem 23, communicates with the fixed infrastructure of GSM PLMN (Public Land Mobile Network) 10 to provide basic voice telephony services. In addition, the mobile entity 20 includes a data-handling subsystem 25 interworking, via data interface 24, with the radio subsystem 22 for the transmission and reception of data over a data-capable bearer service provided by the PLMN; the data-capable bearer service enables the mobile entity 20 to communicate with a service system 40 connected to the public Internet 39. The data handling subsystem 25 supports an operating environment 26 in which applications run, the operating environment including an appropriate communications stack.

More particularly, the fixed infrastructure 10 of the GSM PLMN comprises one or more Base Station Subsystems (BSS) 11 and a Network and Switching Subsystem NSS 12. Each BSS 11 comprises a Base Station Controller (BSC) 14 controlling multiple Base

Transceiver Stations (BTS) 13 each associated with a respective "cell" of the radio network. When active, the radio subsystem 22 of the mobile entity 20 communicates via a radio link with the BTS 13 of the cell in which the mobile entity is currently located. As regards the NSS 12, this comprises one or more Mobile Switching Centers (MSC) 15 together with other elements such as Visitor Location Registers 32 and Home Location Register 32.

When the mobile entity 20 is used to make a normal telephone call, a traffic circuit for carrying digitised voice is set up through the relevant BSS 11 to the NSS 12 which is then responsible for routing the call to the target phone (whether in the same PLMN or in another network).

With respect to data transmission to/from the mobile entity 20, in the present example three different data-capable bearer services are depicted though other possibilities exist: A first data-capable bearer service is available in the form of a Circuit Switched Data (CSD) service; in this case a full traffic circuit is used for carrying data and the MSC 32 routes the circuit to an InterWorking Function IWF 34 the precise nature of which depends on what is connected to the other side of the IWF. Thus, IWF could be configured to provide direct access to the public Internet 39 (that is, provide functionality similar to an IAP - Internet Access Provider IAP). Alternatively, the IWF could simply be a modem connecting to a PSTN; in this case, Internet access can be achieved by connection across the PSTN to a standard IAP.

A second, low bandwidth, data-capable bearer service is available through use of the Short Message Service that passes data carried in signalling channel slots to an SMS unit which can be arranged to provide connectivity to the public Internet 39.

A third data-capable bearer service is provided in the form of GPRS (General Packet Radio Service which enables IP (or X.25) packet data to be passed from the data handling system of the mobile entity 20, via the data interface 24, radio subsystem 21 and relevant BSS 11, to a GPRS network 17 of the PLMN 10 (and vice versa). The GPRS network 17 includes a SGSN (Serving GPRS Support Node) 18 interfacing BSC 14 with the network 17, and a

GGSN (Gateway GPRS Support Node) interfacing the network 17 with an external network (in this example, the public Internet 39). Full details of GPRS can be found in the ETSI (European Telecommunications Standards Institute) GSM 03.60 specification. Using GPRS, the mobile entity 20 can exchange packet data via the BSS 11 and GPRS network 17 with entities connected to the public Internet 39.

The data connection between the PLMN 10 and the Internet 39 will generally be through a firewall 35 with proxy and/or gateway functionality.

Different data-capable bearer services to those described above may be provided, the described services being simply examples of what is possible.

In Figure 1, a service system 40 is shown connected to the Internet 40, this service system being accessible to the OS/application 26 running in the mobile entity by use of any of the data-capable bearer services described above. The data-capable bearer services could equally provide access to a service system that is within the domain of the PLMN operator or is connected to another public or private data network.

With regard to the OS/application software 26 running in the data handling subsystem 25 of the mobile entity 20, this could, for example, be a WAP application running on top of a WAP stack where "WAP" is the Wireless Application Protocol standard. Details of WAP can be found, for example, in the book "Official Wireless Application Protocol" Wireless Application Protocol Forum, Ltd published 1999 Wiley Computer Publishing. Where the OS/application software is WAP compliant, the firewall will generally also serve as a WAP proxy and gateway. Of course, OS/application 26 can comprise other functionality (for example, an e-mail client) instead of, or additional to, the WAP functionality.

The mobile entity 20 may take many different forms. For example, it could be two separate units such as a mobile phone (providing elements 22-24) and a mobile PC (data-handling system 25) coupled by an appropriate link (wireline, infrared or even short range radio system such as Bluetooth). Alternatively, mobile entity 20 could be a single unit such as a mobile phone with WAP functionality. Of course, if only data transmission/reception is

required (and not voice), the phone functionality 24 can be omitted; an example of this is a PDA with built-in GSM data-capable functionality whilst another example is a digital camera (the data-handling subsystem) also with built-in GSM data-capable functionality enabling the upload of digital images from the camera to a storage server.

Whilst the above description has been given with reference to a PLMN based on GSM technology, it will be appreciated that many other cellular radio technologies exist and can typically provide the same type of functionality as described for the GSM PLMN 10.

Recently, much interest has been shown in "location-aware" services for mobile users, these being services that take account of the current location of the user (or other mobile party). A number of different ways exist for determining the location of a mobile entity and Figure 1 depicts the case of location determination being done in the network (for example, by making Timing Advance measurements for three BTSs 13 and using these measurements to derive location) with the resultant location data being passed to a location server 37 from where it can be made available to the mobile entity concerned and authorised services. Typically, location determination is only done when a location request is received at the location server, the latter then being responsible for initiating location determination and providing the result to the requesting entity. The location server 37 can be connected as a resource accessible via the GPRS network 17.

It is known to pre-pay for use of PLMN resources (typically voice traffic and SMS services) with the subscriber being centrally credited with an amount corresponding to their pre-payment; this initial credit amount is decremented according to the subscriber's use of the PLMN resources until no more credit exists at which time provision of services is suspended. The subscriber can replenish their credit amount by making additional payments generally at any time either before or after the initial credit amount has been used up. The use of network resources is tracked at key points (typically the MSC) which generate billing records for billable events, these records being passed back to the central accounting system where they are matched against the subscriber – if the subscriber is on a pre-payment scheme, the current credit amount is then adjusted according to the billing records. The reduction in credit will depend not only on how long a particular resource

(e.g. voice traffic circuit) has been used, but also on factors such as time of day and quality of service.

Current implementations of pre-payment systems lack flexibility and responsiveness and it is an object of the present invention to provide an improved pre-payment method and system.

Summary of the Invention

According to the present invention, there is provided a method of operating a communications infrastructure having a plurality of metered resources, the method involving:

- recording pre-payment of an amount by a user for use of the metered resources;
- distributing at least a portion of said amount as credit values held in user-specific virtual purses each associated with a respective said metered resource; and
- upon use of a metered resource by the user, correspondingly reducing the credit value held in the associated purse, with use of the resource being dependent on the credit value in the purse being above a pre-determined threshold (typically zero but possibly a positive or negative figure).

The virtual purses are preferably located at or close to their associated resources; however, it is also possible to locate all the purses centrally.

As used herein the term "metered resource" means any infrastructure element or service the use of which is a billable event.

According to another aspect of the present invention, there is provided a communications infrastructure comprising:

- a plurality of metered resources,
- a respective purse subsystem associated with each metered resource for providing user-specific virtual purses for that resource;

- a pre-payment system for recording pre-payment of an amount by a user for use of the metered resources, the pre-payment system including a distribution arrangement for distributing at least a portion of said amount as credit values to virtual purses held by the purse subsystems for that user; and
- a respective usage-control arrangement associated with each metered resource and operative to permit use of that resource by a user only when the credit value in the user's purse for that resource is above a predetermined threshold, the purse subsystem associated with the resource being operative to reduce the credit value held in the user's purse in accordance with usage of the resource by that user.

Brief Description of the Drawings

A method and system, both embodying the present invention, for operating a communications infrastructure on a pre-payment basis, will now be described, by way of non-limiting example, with reference to the accompanying diagrammatic drawings, in which:

- **Figure 1** is a diagram of a known communications infrastructure usable for transferring voice and data to/from a mobile entity; and
- **Figure 2** is a diagram illustrating the operation of a GPRS network of the Figure 1 communications infrastructure on a pre-payment basis.

Best Mode of Carrying Out the Invention

The present invention is described hereinafter in relation to pre-paid usage of particular resources of the GPRS network 17 of the Figure 1 system, this GPRS network being shown in more detail in Figure 2 along with a pre-payment system 60. For simplicity, no description is given as to how a user pays for use of the PLMN 10 other than GPRS network 17, it being possible to use any appropriate charging mechanism for such use (including the pre-payment mechanism to be described below in relation to the GPRS network).

As shown in Figure 2, the GPRS network 17 comprises, in addition to the SGSN node 18 and GGSN node 19, switching nodes 50 to 53. Connected to switching node 52 is a database resource 54 (for example, a directory resource) whilst the location server 37 is connected to switching node 51. The nodes 18, 19, 50, the database 54 and the location server 57 each constitute a metered resource, that is, use of the resource is a billable event and results in the generation of a billing record. Associated with each metered resource is a purse sub-system 77 for holding user-specific virtual purses; each the purse subsystem is, for example, embodied as software running on the same processor as the metered resource or on an associated processor local to the resource whereby communication of billing events from the metered resource to the associated purse sub-system is local and does not consume GPRS network resources.

The pre-payment system 60 is a central facility for PLMN 10 and is used for administering pre-payment tariff customers. The system 60 has a pre-payment database 61holding a respective record 62 for each pre-payment customer. This record holds the current credit amount 64 attributed to each pre-payment customer, the amount being initially set upon initial sign-up of a customer through sign-up process 67 and being subsequently replenished using top-up process 68.

User record 62 also holds a distribution pattern specifying how the credit amount is to be allocated between metered resources, this distribution being in terms of the relative values between the metered resources - for example, the relative values may be specified to be:

Node 18:	10
Node 19:	10
Node 50:	5
Database 54:	5
Location Server 37:	8

The distribution pattern can be initially set to a default pattern reflecting average usage by all users or can be set according to a pattern specified by the user. Preferably, the initial pattern is subsequently modified to reflect the actual pattern of usage by the user concerned. Of course, since different resources will generally be differently priced, the

distribution pattern will generally reflect not only how often a resource is used but also its relative cost compared to the other resources.

The record 62 for each user also contains rating rule information that specifies or indicates the charging rates to be applied by each resource for the user concerned. These charging rates will generally be time of day dependent and quality-of-service dependent. The rating rule information need only indicate an appropriate scale to be used where the charging rates are organised in scales that are known to the purse sub-systems 77.

In the present arrangement, when a pre-payment user is first recorded as present in the PLMN (registered with the HLR), a "registration" indicator is passed to the pre-payment system from the HLR (arrow 78). This initiates a process 70 that distributes (arrow 80) the credit amount 64 specified in the user's record 62 to user-specific virtual purses 55-59 that are created as needed in the purse sub-systems 77 associated with the metered resources 18, 19, 50, 54, 37. The credit amount 64 is distributed between purses according to the distribution pattern 65 for that user. At the same time, rating rule information for the user is passed to the purse sub-systems 77. The whole of the amount 64 can be distributed at one go; alternatively, a limit can be set as to the maximum amount that can be distributed to the purses.

Thereafter, at each usage of a metered resource by the user, a billing record is generated and passed to the corresponding purse sub-system where the credit value is reduced by an amount dependent on the resource usage and appropriate charging rate as set by the rating rule information. Continued usage of a metered resource is dependent on there being sufficient credit value in the corresponding purse, that is, the credit value being above a predetermined threshold, typically zero but possibly either a positive value (e.g. a value equal to the minimum usage amount for the resource concerned) or a negative value (where a degree of debt is permitted).

When a user ceases to be present in the PLMN (that is, is de-registered in the HLR), a "de-registration" indicator (arrow 79) is passed to the pre-payment system 60, triggering a process 71. Process 71 collects the remaining credit values from the user's purses (which

are thereupon destroyed) and consolidates these values into a remaining amount which replaces the previous credit amount 64 in record 62. At the same time, process 71 re-calculates an appropriate distribution pattern for the user, taking account of the resource usage made during the last session of use, this new pattern replacing the previous pattern in record 62. The billing records showing the usage made of each resource are consolidated at each purse sub-system and passed from there to an accounting system (not shown).

In the event that the user tops up their credit amount whilst registered (that is, whilst the previous credit of the user is distributed between the purses), the top-up amount is temporarily held in record 62 and then added on to the consolidated remaining amount derived by process 71.

The triggering of processes 70 and 71 can be from "presence" events more immediate to the use of GPRS network that the mere registration / de-registration of the user with the HLR. Thus, the distribution process 70 could be triggered off the user initiating a connection with the PLMN or, even more specifically, upon the user seeking to use the GPRS network; similarly, process 71 can be triggered off connection termination or cessation of use of the GPRS network.

A number of different procedures can be used to compensate for the depletion of credit values in the virtual purses whilst a user is present and the credit amount 64 is distributed between the purses. Thus, for example, where only part of the amount 64 was initially distributed, when the credit value in a particular purse falls below a certain level, the purse can request that it be replenished from the withheld amount.

Another replenishment mechanism involves a re-distribution of the remaining credit values held in the purses to re-establish the initial distribution pattern (or to establish a new pattern that takes account of the latest relative usage of the resources) – see process 72. Process 72 can be triggered, for example, by one of the purses falling below a particular level and/ or by expiration of a set time interval.

Yet another replenishment mechanism, suitable as a last resort, involves designating certain of the metered resources as more important than others; in this case, a purse associated with a more important resource will be replenished when reaching a threshold low level from a purse associated with a less important resource (process 73).

Whilst in the above-described arrangement the purses 55-59 have been located at or adjacent the corresponding metered resources, it would also be possible to locate the purses within the pre-payment system itself, though this has the drawback of increasing time-critical billing traffic since now billing records must be passed to the pre-payment system.

It will be appreciated that the GPRS network can simultaneously be used by subscribers who are not on a pre-payment tariff.

It will also be understood that the above-described method and system can be applied to the operation of other communication infrastructures and are not limited to use with GPRS networks.

Furthermore, where the communications infrastructure comprises a plurality of networks each with metered resources, and the user can only be present in only one network at a time, a user's credit can be distributed to the network where the user currently is and then, when the user leaves that network, the remaining credit value can be collected back ready for re-distributing in the network where the user is next present.

It may also be desirable to provide a mechanism for calling back or drawing down the credit amounts in the purses when the user incurs a charge in relation to some other chargeable event not associated with the usage of the metered resources.

The metered resources can simply be perimeter nodes of the network subject to pre-payment usage - whilst this does not fully meter usage of internal resources it does catch traffic moving across the network boundaries.

Where the communications infrastructure is a PLMN, both mobile originating and mobile terminated traffic can be subject to the above-described pre-payment mechanism.

CLAIMS

1. A method of operating a communications infrastructure having a plurality of metered resources, the method involving:

- recording pre-payment of an amount by a user for use of the metered resources;
- distributing at least a portion of said amount as credit values held in user-specific virtual purses each associated with a respective said metered resource; and
- upon use of a metered resource by the user, correspondingly reducing the credit value held in the associated purse, with use of the resource being dependent on the credit value in the purse being above a predetermined threshold.

2. A method according to claim 1, wherein the virtual purses are located at or near to their respective associated metered resources.

3. A method according to claim 1, wherein the distribution of credit values to the virtual purses is effected upon the user being determined as present in relation to the communications infrastructure, the remaining credit values in the purses being re-consolidated to a remaining amount upon the user ceasing to be present.

4. A method according to claim 1, wherein the distribution of credit values to the virtual purses is effected according to a given pattern of relative values between the purses.

5. A method according to claim 4, wherein said given pattern is determined according to the user's relative usage of the metered resources over a preceding period.

6. A method according to claim 1, wherein charge rate information is distributed with the credit values whereby to enable the reduction of credit values to be effected according to a charging rate applicable to the user and usage.

7. A method according to claim 1, wherein following an initial distribution of credit values to the virtual purses, a sum remains, this sum being at least partially subsequently

distributed to replenish one or more of the purses following a depletion as a result of usage of the corresponding resource.

8. A method according to claim 1, wherein the credit values held in said purses are re-distributed to a given pattern of relative values in at least one of the following circumstances:

- the credit value in one of the purses falling below a particular level;
- on time out of a predetermined period.

9. A method according to claim 8, wherein said given pattern is determined taking account of the user's relative usage of the metered resources over the immediately preceding period of usage.

10. A method according to claim 8, wherein certain of said resources are designated as more important than others, a purse associated with a more important resource being replenished when reaching a threshold low level from a purse associated with a less important resource.

11. A method according to claim 1, wherein the communications infrastructure comprises a plurality of networks each with metered resources, the user being present in only one said network at a time and the steps of credit-value distribution and reduction being effected only in relation to resources of the network where the user is present, the credit values remaining after usage of that network being consolidated to a remaining amount upon the user ceasing to be present in a network whereby that remaining amount is available for distribution upon the user becoming present again in a said network.

12. A communications infrastructure comprising:

- a plurality of metered resources,
- a respective purse subsystem associated with each metered resource for providing user-specific virtual purses for that resource;
- a pre-payment system for recording pre-payment of an amount by a user for use of the metered resources, the pre-payment system including a distribution arrangement

for distributing at least a portion of said amount as credit values to virtual purses held by the purse subsystems for that user; and

- a respective usage-control arrangement associated with each metered resource and operative to permit use of that resource by a user only when the credit value in the user's purse for that resource is above a predetermined threshold, the purse subsystem associated with the resource being operative to reduce the credit value held in the user's purse in accordance with usage of the resource by that user.

13. An infrastructure according to claim 12, wherein the purse subsystems and the usage-control arrangements are located at or near to their respective associated metered resources.

14. An infrastructure according to claim 12, further comprising a presence-detection system for detecting when a user is present to the communications infrastructure, the pre-payment system being operative to distribute credit values to the virtual purses upon the user being determined as present by said presence-detection system, and the pre-payment system being further operative, upon the user ceasing to be present as determined by the presence-detection system, to re-consolidate the remaining credit values in the purses to a remaining amount in the pre-payment system.

15. An infrastructure according to claim 12, wherein the pre-payment system is operative to distribute credit values to the virtual purses according to a given pattern of relative values between the purses.

16. An infrastructure according to claim 15, wherein said given pattern is determined according to the user's relative usage of the metered resources over a preceding period.

17. An infrastructure according to claim 12, wherein the pre-payment system is operative to distribute charge rate information with the credit values whereby to enable the reduction of credit values to be effected according to a charging rate applicable to the user and usage.

18. An infrastructure according to claim 12, wherein the pre-payment system is operative initially to distribute only part of said amount as credit values to the virtual purses thereby

leaving an initial undistributed sum, the pre-payment system being further operative to distribute at least some of the undistributed sum to replenish one or more of the purses following a depletion by the corresponding usage-control arrangement as a result of usage of the corresponding resource.

19. An infrastructure according to claim 12, wherein the pre-payment system is operative to re-distribute the credit values held in said purses to a given pattern of relative values in at least one of the following circumstances:

- the credit value in one of the purses falling below a particular level;
- on time out of a predetermined period.

20. An infrastructure according to claim 19, wherein said given pattern is determined taking account of the user's relative usage of the metered resources over the immediately preceding period of usage.

21. An infrastructure according to claim 19, wherein certain of said resources are designated as more important than others, a purse associated with a more important resource being replenished when reaching a threshold low level from a purse associated with a less important resource.

22. An infrastructure according to claim 12, comprising a plurality of networks each with metered resources, and a presence detection system for determining when a user is present in one of the networks, the pre-payment system being operative to distribute said amount only in relation to resources of the network where the user is present, with the credit values remaining after usage of that network being consolidated to a remaining amount in the pre-payment system upon the user ceasing to be present in a network whereby that remaining amount is available for distribution upon the user becoming present again in a said network.

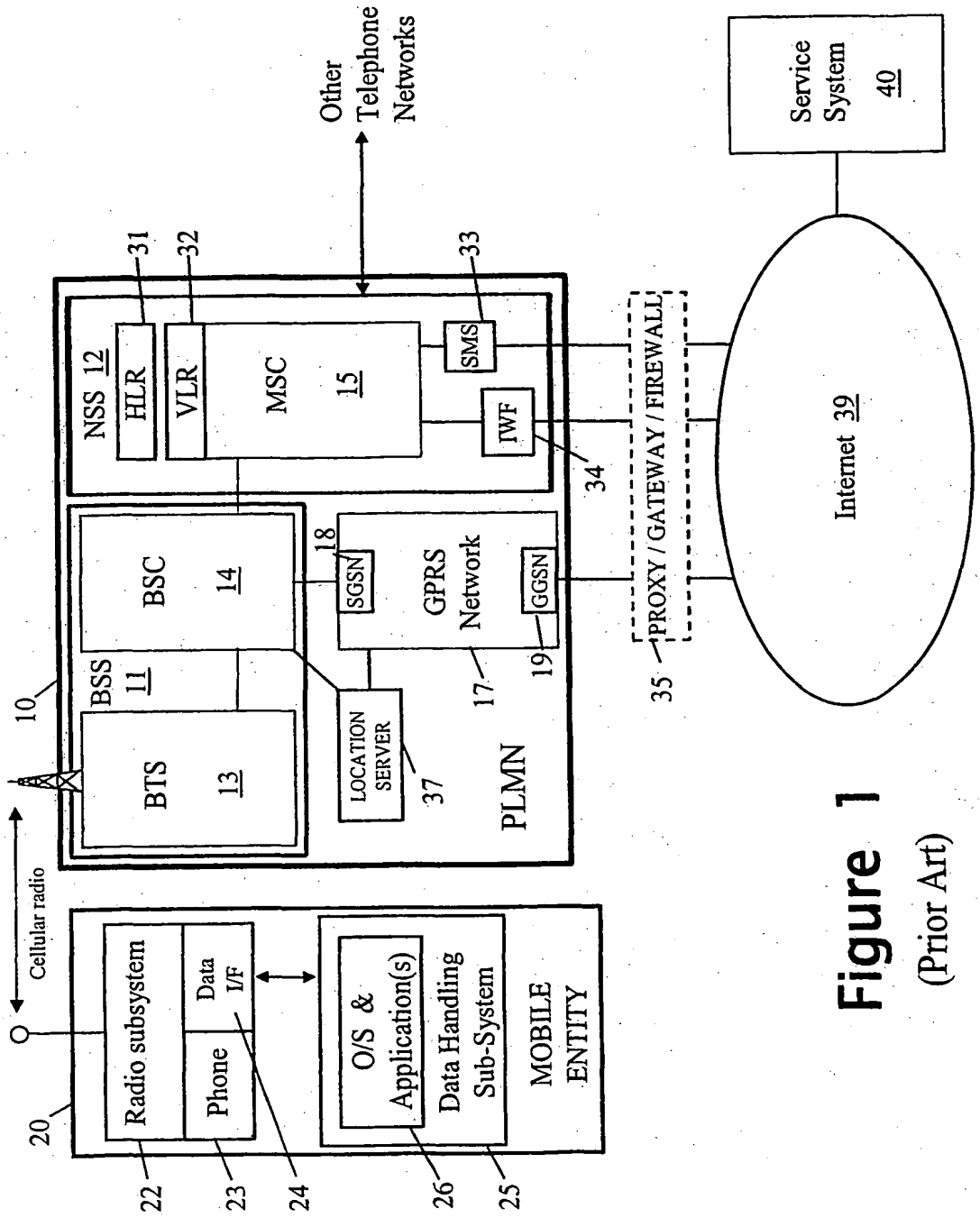
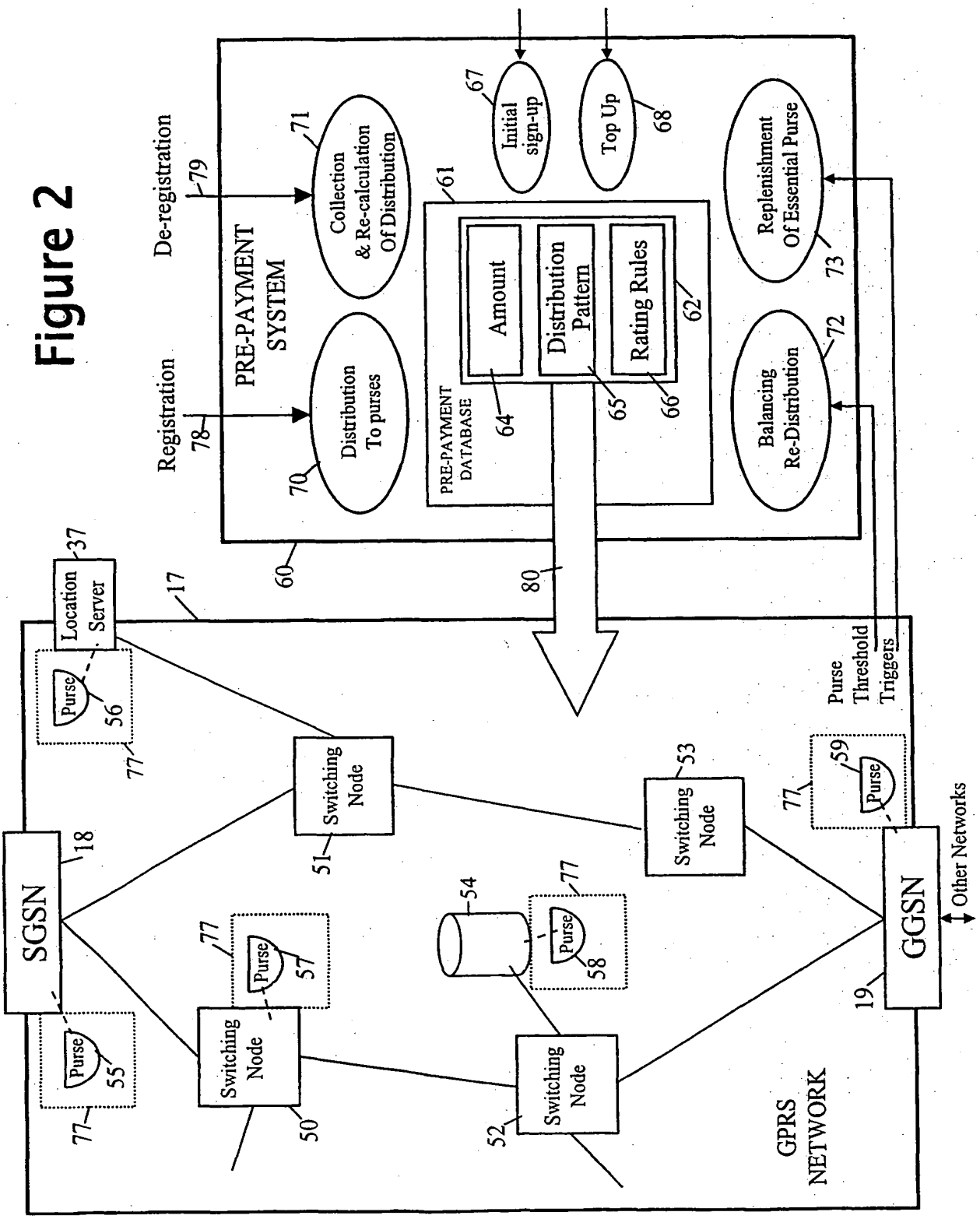


Figure 1
(Prior Art)

Figure 2


PRE-PAYMENT SYSTEM
De-registration
79
Registration
78
Collection & Re-calculation Of Distribution
71
Distribution To purses
70
Initial sign-up
67
Top Up
68
61
Amount
Distribution Pattern
Rating Rules
62
PRE-PAYMENT DATABASE
64
65
66
Replenishment Of Essential Purse
73
Balancing Re-Distribution
72
60
80
17
Location Server
37
Purse
56
77
Purse Threshold Triggers
SGSN
18
Switching Node
51
Switching Node
53
Purse
59
77
Other Networks
GGSN
19
54
77
Purse
58
Purse
57
77
Switching Node
50
Switching Node
52
Purse
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GPRS NETWORK

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(71) Applicant *(for all designated States except US)*: **HEWLETT-PACKARD COMPANY** [US/US]; 3000 Hanover Street, Palo Alto, CA 94304 (US).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **I'ANSON, Colin** [GB/GB]; 16 Kynges Mill Close, Frenchay, Bristol BS16 1JL (GB).

(74) Agent: **SQUIBBS, Robert, Francis**; Hewlett-Packard Limited, Intellectual Property Section, Filton Road, Stoke Gifford, Bristol BS34 8QZ (GB).

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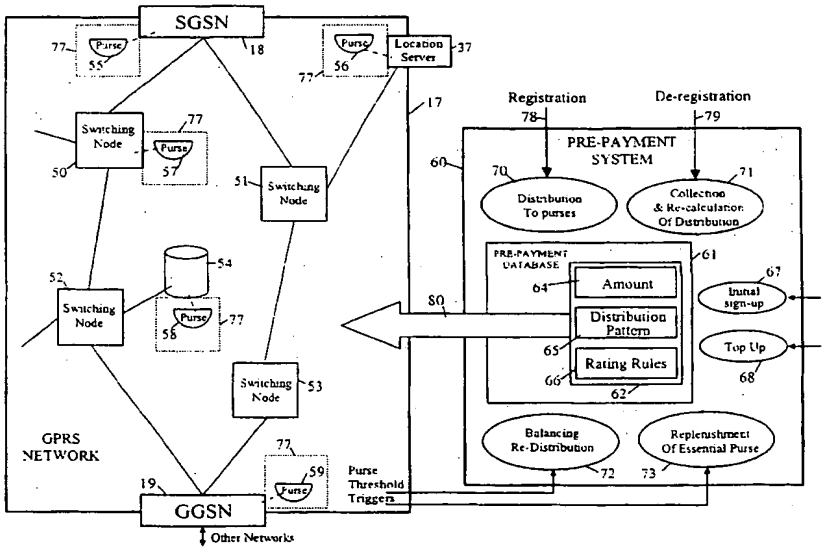

(57) Abstract: Subscribers to a communications infrastructure, such as a GPRS network (17), can pre-pay for use of metered resources (18, 19, 37, 50, 54) of the infrastructure. When a pre-payment subscriber joins the network, the current credit amount for the subscriber is distributed as credit values between user-specific virtual purses (55-59) each associated with a respective metered resource. Upon use of a metered resource by the subscriber, the credit value held in the associated purse is correspondingly reduced, with use of the resource being dependent on the purse being in credit. The virtual purses are preferably electronically distributed to be close by the metered resources to which they relate whereby to reduce network billing traffic. When the subscriber leaves the network, the remaining credit values are consolidated from the purses.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M17/00 H04M15/00 H04Q7/00 H04L12/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 332 337 A (CELLCOM LTD) 16 June 1999 (1999-06-16) claims 1-4,9-15	1-22
A	EP 0 917 337 A (LUCENT TECHNOLOGIES INC) 19 May 1999 (1999-05-19) paragraph '0005!	1-22
A	WO 99 65183 A (BRISCOE ROBERT JOHN ;RIZZO MICHAEL (GB); BRITISH TELECOMM (GB)) 16 December 1999 (1999-12-16) claims 1-3,18-22	1-22
A	WO 00 05871 A (ERICSSON TELEFON AB L M) 3 February 2000 (2000-02-03) claims 1-26	1-22

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

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'O' document referring to an oral disclosure, use, exhibition or other means

'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search repon
16 May 2002	31/05/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Patlaka, E.

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INTERNATIONAL SEARCH REPORT

Intel ɔnal Application No
PCT/GB 01/01989

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 30480 A (BELLSOUTH CORP) 17 June 1999 (1999-06-17) claim 1	1-22

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter[illegible]nal Application No
PCT/GB 01/01989

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2332337 A	16-06-1999	FR 2786585 A1	02-06-2000
		GB 2342006 A ,B	29-03-2000
EP 0917337 A	19-05-1999	US 6009156 A	28-12-1999
		DE 69800109 D1	04-05-2000
		DE 69800109 T2	21-09-2000
		EP 0917337 A1	19-05-1999
		JP 11239232 A	31-08-1999
WO 9965183 A	16-12-1999	AU 4157599 A	30-12-1999
		AU 4158099 A	30-12-1999
		AU 4158199 A	30-12-1999
		CN 1310651 T	29-08-2001
		CN 1311933 T	05-09-2001
		CN 1311934 T	05-09-2001
		EP 1119943 A2	01-08-2001
		EP 1119944 A2	01-08-2001
		EP 1123604 A2	16-08-2001
		WO 9965183 A2	16-12-1999
		WO 9965184 A2	16-12-1999
		WO 9965185 A2	16-12-1999
WO 0005871 A	03-02-2000	US 6185414 B1	06-02-2001
		AU 5541099 A	14-02-2000
		BR 9912390 A	24-04-2001
		WO 0005871 A1	03-02-2000
WO 9930480 A	17-06-1999	US 6226364 B1	01-05-2001
		AU 2085799 A	28-06-1999
		WO 9930480 A1	17-06-1999